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Are the school version of the assessment of motor and process skills measures valid for German-speaking children?

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ABSTRACT

Background: There are no validated assessment tools for evaluating quality of schoolwork task performance of children living in German-speaking Europe (GSE).

Objective: To determine whether the international age-normative means of the School Version of the Assessment of Motor and Process Skills (School AMPS) are valid for use in GSE.

Methods: The participants were 159 typically-developing children, 3-12 years, from GSE. We examined the proportions of School AMPS measures falling within ± 2 standard deviation (SD) of the international age-normative means, and evaluated for significant group differences ($p < 0.05$) in mean School AMPS measures between the GSE sample and the international age-normative sample using one-sample Z tests. When significant mean differences were found, we evaluated if the differences were clinically meaningful.

Results: At least 95% of the GSE School AMPS measures fell within ± 2 SD of the international age-normative means for the School AMPS. The only significant mean differences were for 6- ($p < 0.01$) and 8-year-olds ($p = 0.02$), and only the 6-year-old school process mean difference was clinically meaningful.

Conclusions: Because the only identified clinically meaningful difference was associated with likely scoring error of one rater, the international age-normative means of the School AMPS appear to be valid for use with children in GSE.

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Cross-cultural comparison; occupational therapy; schoolwork performance; school health services; children

Engagement in occupation is the primary focus of occupational therapy. It should, therefore, be the focus of the occupational therapy intervention process, be it in the evaluation and goal-setting phase, the intervention phase, or the reevaluation phase. This focus requires the use of available assessment tools for evaluating both reported and observed quality of occupational performance [1]. For occupational therapists working with children, the ability to perform schoolwork tasks becomes one area of occupational performance that should be in focus.

When using assessments, validity is an important consideration [2]. One aspect of validity evidence is cross-regional validity, including evidence that supports the use of an assessment in different world regions without placing people from one world region at a disadvantage [2].

Within German-speaking Europe (GSE), defined in this study as German-speaking Switzerland, Austria, and Germany, there currently are only two standardized occupational therapy assessments appropriate for use in pediatrics with evidence supporting their valid use in GSE [3,4]. Both assessment tools, the Assessment of Motor and Process Skills (AMPS) [5,6] and the German Pediatric Evaluation of Disability Inventory (PEDI-G) [7], were developed for evaluating performance of activities of daily living (ADL) tasks. In contrast, there is a critical lack of assessment tools with evidence supporting their valid use in GSE that can be used to evaluate a child's quality of schoolwork task performance. This assertion is supported by a recent survey of German occupational therapists that revealed a need for occupation-focused and occupation-based assessments for use in school settings [8].

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According to Fisher [1], assessment tools can be occupation-focused, occupation-based, both, or neither. Occupation-focused assessments place the immediate focus of the evaluation on occupation (e.g. does the child cut the paper independently) and occupation-based assessments involve evaluating a child while he or she is engaged in occupation (e.g. observing the child cutting the paper). When an occupational therapist observes someone while he or she is engaged in occupation and focuses the evaluation of the person's quality of that occupational performance, the assessment is both occupation-based and occupation-focused. In contrast, if the focus of the assessment is on understanding how underlying body functions affect occupational performance (e.g. does the child demonstrate visual spatial problems or dyspraxia that impacts cutting), the assessment is occupation-based but not occupation-focused.

The School Version of the Assessment of Motor and Process Skills (School AMPS) [9] is the only occupation-focused and occupation-based assessment tool reported in the literature designed to evaluate a child's quality of performance of a variety of schoolwork tasks. Other school-related assessments are occupation-focused but not occupation-based (e.g. School Setting Interview) [10] or allow evaluation of writing only (e.g. Writing Readiness Inventory Tool in Context) [11].

The School AMPS is an internationally standardized assessment tool that is used to evaluate children 3 to 15 years, with or without identified disabilities or diagnoses. It is used to evaluate a child's quality of schoolwork task performance (e.g. writing, colouring, cutting) in terms of small observable units of occupational performance (i.e. occupational performance skills such as reaching for, choosing, and grasping a pencil). The administration of the School AMPS begins by interviewing the teacher to gain an understanding of the child, the classroom environment, and daily classroom routines. In this first step, the teacher identifies and prioritizes a minimum of two schoolwork tasks that are problematic or challenging for the child. In a next step, the occupational therapist observes the child perform those two tasks in the child's classroom during normal classroom routines. Then, the occupational therapist scores the 16 school motor and 20 school process items of the School AMPS by using a four-category rating scale (4 = competent, 3 = questionable, 2 = ineffective, 1 = deficit) [9]. Raw data for both schoolwork tasks are then entered into the School AMPS software included in the Occupational Therapy Assessment Package [12] that is used to generate the child's school motor and

school process measures, expressed in linear log-odds probability units (logits). Those measures can then be interpreted based on norm-referenced and criterion-referenced standards [9]. Norm-referenced interpretations are used to determine if a child's quality of schoolwork task performance is within the normative range or if the child's performance is sufficiently below age expectations to be eligible for occupational therapy services [13].

Despite the wide utility of the School AMPS, only one study has examined whether the School AMPS is valid between different world regions [14]. The results revealed that despite the presence of minimal differential item functioning, the School AMPS measures are not biased among North America, Australia and New Zealand, United Kingdom, and the Nordic countries. While Munkholm et al. [14] did not include GSE in their study because there were insufficient data available for children from GSE, the results of her study suggest that the School AMPS scales are likely valid for other world regions, including German-speaking Europe.

To date, another aspect of cross-cultural validity – the validity of the international normative means in different world regions (e.g. GSE) – has never been examined. The standardized administration and scoring procedures of the School AMPS were designed to account for cross-cultural differences (e.g. the child is assessed based on how schoolwork tasks are typically performed within the natural cultural context) [9]. Therefore, the School AMPS measures are asserted to be free of cross-cultural normative differences. Yet, there remains a possibility that factors such as the culture or language of a world region may influence the way children engage in occupation. Thus, there is a risk that the normative means differ among world regions. We, therefore, implemented this study to obtain preliminary evidence that the School AMPS normative means are valid for children living in GSE. Our research questions were as follows:

1. Do at least 95% of school motor and school process measures of typically-developing children between 3 and 12 years living in GSE, specifically German-speaking Switzerland, Germany, or Austria, fall within ± 2 SD of the age-normative means for the international standardization sample for the School AMPS?
2. Are there statistically significant differences between the international age-normative means of the School AMPS and those of children 5, 6, 7 or 8 years living in Switzerland, Germany, or Austria?

3. If there are statistically significant differences, are they large enough to be clinically meaningful (i.e. do they differ by more than the international mean *SE* for the School AMPS measures)?

Method

Research design

This study used a retrospective, cross-sectional design where data for children from GSE were extracted from the international School AMPS database, Ft. Collins, USA. The study design was submitted to The Ethics Committee of Canton Zurich that stated that the secondary analysis of anonymous medical data from the School AMPS database did not require ethics committee approval.

Participants

The participants were typically-developing children from Switzerland, Germany, and Austria. Inclusion criteria were (1) children between 3 and 12 years old, (2) living in GSE, and (3) without known disability or diagnosis. The lower age boundary represents the minimum age of children evaluated with the School AMPS and the upper age boundary was necessary because there were no available data for typically-developing children above 12 years in the School AMPS database. All data associated with extreme rater scoring error were excluded (e.g. measures that exceeded the range of the School AMPS scales).

Measure

Existing evidence of validity reveals that mean School AMPS measures increase significantly with age [9] and are sensitive enough to differentiate between the performance of typically-developing children and of children at risk or with different diagnoses (e.g. mild, developmental/neurological, cognitive/psychological, other multiple disabilities) [9,15]. Furthermore, research has revealed no gender bias for typically-developing children or children at risk or with mild disabilities [16]. Munkholm, Löfgren, and Fisher [17] found high reliability coefficients ($r \geq 0.70$) and low standard errors (*SE*; school motor = 0.28 logit, school process = 0.22 logit). High inter- and intra-rater reliability was determined by goodness of fit of the raters to the many-faceted Rasch (MFR) model of the School AMPS (96% on School AMPS motor scale, 91% on the School AMPS process scale, $MnSq \leq 1.4$ and $z < 2$) [9].

Procedures

The available data in the School AMPS database had been submitted by 20 occupational therapists from GSE either during their calibration process to become a valid School AMPS rater or for research purposes. These therapists were representative of those working with children in this region. All School AMPS raters are responsible for obtaining consent from the parents of the children before submitting data. The raters who evaluated the participants included in this study had been trained to administer and score the School AMPS in a valid and reliable manner according to the standardized procedures outlined in the School AMPS manual [9]. The participants were evaluated between November 2006 and July 2015; their anonymous data were extracted from the database in August 2015. Gender was not considered because previous research revealed no gender bias for typically-developing children when using the School AMPS [16].

Data analysis

School AMPS measures were generated using FACETS, an MFR analysis program [18]. The MFR analysis for the School AMPS scales consider four facets (items, tasks, rater, child) and convert each child's ordinal raw item scores into school motor and school process measures that are reported in logits [19]. More specifically, MFR analysis converts the child's raw school motor and school process item scores for all observed schoolwork tasks into a single linear school motor measure and a single linear school process measure that have been adjusted to account for the challenges of the observed schoolwork tasks, the hierarchy of the items, and the severity of the calibrated rater who scored the child's schoolwork task performance. Data were entered into the software package IBM SPSS 22 [20] which was used to perform statistical analyses.

Proportions of School AMPS measures within age expectations

Calculated proportions were examined to evaluate if at least 95% of the school motor and school process measures for the total GSE sample fell within ± 2 *SD* of the age-normative means of the School AMPS. For this each child's standardized *z* scores of his or her school motor and school process measures were coded as either being within or outside ± 2 *SD* of the age normative mean for that age group. The same procedure was used to determine if at least 95% of the

school motor and school process measures for children from each country, Switzerland, Germany, and Austria, fell within ± 2 SD.

Statistically significant differences within age groups

For age groups with at least 30 participants in the GSE sample (i.e. 5, 6, 7, and 8 years), one-sample Z tests were performed to evaluate if the GSE means differed significantly from the international age-normative means of the School AMPS. At the time of this analysis, there were 31 children from GSE included in the international School AMPS standardization sample ($n = 2563$). To ensure that their inclusion in both samples did not affect the validity of our results, we verified that the removal of those children resulted in virtually identical means and SDs (unpublished data). The level of significance was $p < 0.05$ (two-tailed).

Clinically meaningful differences within age groups

For those age groups where the one-sample Z test revealed a statistically significant difference between means, the mean difference was evaluated to determine if it was clinically meaningful. In this study, we set the criterion for a clinically meaningful difference as one that was equal to or greater than the

international mean SE for school motor (0.28 logits) or school process measures (0.22 logits). The decision to use the mean SE of the School AMPS was based on previous research [16,21].

Results

Demographic characteristics

In total, 159 children met the inclusion criteria. Sixty-three children were from Switzerland, 31 from Germany, and 65 from Austria. Demographic characteristics are presented in Table 1.

Proportions of School AMPS measures within age expectations

Ninety-five percent of the school motor and 95.6% of school process measures of typically-developing children living in GSE fell within ± 2 SD of the age-normative means for the international standardization sample of the School AMPS (Table 2). When we examined the data by country, we found that $\geq 95\%$ of school motor measures of children living in Switzerland and Germany and $\geq 95\%$ of school process measures of children living in Austria fell within ± 2 SD. For school motor measure of children living in Austria and school process measures of children living in Switzerland and Germany $\leq 95\%$ fell within ± 2 SD (Table 2).

Table 1. Demographic data: age, gender, and country of residence of the participants.

Characteristic	Age group, years										Total
	3	4	5	6	7	8	9	10	11	12	
Gender, n (%)											
Female	2 (40.0)	2 (50.0)	13 (40.6)	32 (78.0)	15 (46.9)	20 (62.5)	1 (33.3)	3 (42.9)	0 (0.0)	0 (0.0)	88 (55.3)
Male	3 (60.0)	2 (50.0)	19 (59.4)	9 (22.0)	17 (53.1)	12 (37.5)	2 (66.7)	4 (57.1)	2 (100.0)	1 (100.0)	71 (44.7)
Country of residence, n (%)											
Switzerland	0 (0.0)	3 (75.0)	23 (71.9)	7 (17.1)	8 (25.0)	14 (43.8)	2 (66.6)	4 (57.1)	1 (50.0)	1 (100.0)	63 (39.6)
Germany	4 (80.0)	0 (0.0)	6 (18.8)	4 (9.8)	8 (25.0)	6 (18.8)	1 (33.3)	1 (14.3)	1 (50.0)	0 (0.0)	31 (19.5)
Austria	1 (20.0)	1 (25.0)	3 (9.4)	30 (73.2)	16 (50.0)	12 (37.5)	0 (0.0)	2 (28.6)	0 (0.0)	0 (0.0)	65 (40.9)
Total, N (%)	5 (100.0)	4 (100.0)	32 (100.0)	41 (100.0)	32 (100.0)	32 (100.0)	3 (100.0)	7 (100.0)	2 (100.0)	1 (100.0)	159 (100.0)

Table 2. Percentage of school motor and school process measures of 5- to 8-year-old children that fell within ± 2 SD of the international age-normative means of the School AMPS.

Characteristic	Country			Total
	Switzerland	Germany	Austria	
School motor measure, n	63	31	65	159
Within age-normative range (%)	60 (95.3)	31 (100.0)	60 (92.3)*	151 (95.0)
Outside age-normative range	3	0	5	8
School process measure, n	63	31	65	159
Within age-normative range (%)	59 (93.7)*	29 (93.6)*	64 (98.5)	152 (95.6)
Outside age-normative range	4	2	1	7

* $< 95\%$.

Statistically significant differences within age groups

Means, standard deviations, and 95% CI for age groups with at least 30 children (i.e. 5, 6, 7, and 8 years) are presented in Table 3. One-sample Z tests revealed no statistically significant differences between the GSE and international School AMPS means, except for the school motor measures of 8-year-olds, $Z = -2.35$, $p = 0.02$, and the mean school process measures of 6-year-olds, $Z = 4.65$, $p < 0.01$.

Clinically meaningful differences within age groups

We found no clinically meaningful differences in school motor abilities within any of the age groups. For school process abilities, the only clinically meaningful difference was for the 6-year-old age group (Table 3).

Discussion

The aim of this study was to obtain preliminary evidence related to the use of the international age-normative means of the School AMPS when testing children between 3 and 12 years living in GSE. Our results indicate that, overall, the mean school motor and school process measures of the GSE sample are comparable to the international sample of the School AMPS. These findings are consistent with those of

Gantschnig et al. [21] who found that quality of ADL motor and ADL process task performance of children living in GSE is comparable with children living in other world regions when measured using the AMPS.

Statistically significant and clinically meaningful differences within age groups

When we examined for statistically significant differences within age groups between mean School AMPS measures of the GSE sample and the international age-normative means, we found that only the school motor measures for the 8-year-old children and school process measures for 6-year-old children differed significantly. More importantly, only the mean school process measures for 6-year-old children demonstrated a clinically meaningful difference (i.e. exceeded mean SE of the School AMPS). When we looked more closely at the data for the GSE sample of 6-year-olds to determine if we could identify any reason for this discrepancy, we found many children from GSE had school process measures above the international age-normative means. Moreover, all of the children from GSE with unexpectedly high school process measures had been scored by the same rater. We considered, therefore, the possibility of rater scoring error. That is, while earlier research supports high inter- and intra-rater reliability among School AMPS raters (i.e. 96% for school motor and 91% for school process measures) [9], some raters do vary in severity over time. When raters become more strict or lenient after their original severity calibration as a School AMPS rater, their data will demonstrate error because the School AMPS measures for the children they test will become systematically lower or higher. Such raters no longer score the School AMPS in a valid manner.

An alternative explanation for the differences for both the 6- and 8-year-old age groups might be that children in GSE develop schoolwork task performance at a different rate than do children in other world regions. As we noted earlier, cultural background, including language, tradition, and school system practices, might influence how children living in GSE versus other world regions develop schoolwork task performance. When we examined the pattern of school motor measures and school process measures for the GSE sample across age groups, we found that the mean school motor measures were stable between 5 and 7 years, but dropped slightly at 8 years. In contrast the school process measures gradually increased but were highest at 6 years (Table 3). Yet, quality of schoolwork task performance is assumed to increase

Table 3. Mean school motor and school process measures (logits) for children living in German-speaking Europe compared with the international age-normative means of the School AMPS.

Characteristic	Age group, years			
	5 (n = 32)	6 (n = 41)	7 (n = 32)	8 (n = 32)
School motor, M (SD)				
GSE	2.0 (0.4)	2.0 (0.3)	2.0 (0.4)	1.9 (0.4)
GSE 95% CI	[1.8, 2.1]	[1.9, 2.2]	[1.8, 2.1]	[1.8, 2.1]
International	1.9 (0.4)	2.0 (0.4)	2.0 (0.4)	2.1 (0.4)
Difference	0.10	0.00	0.00	0.20
Z	1.15	0.43	-0.71	-2.35
p	0.25	.66	.48	.02*
School process, M (SD)				
GSE	0.7 (0.4)	1.1 (0.3)	0.9 (0.4)	0.9 (0.3)
GSE 95% CI	[0.6, 0.8]	[1.0, 1.2]	[0.8, 1.0]	[0.7, 1.0]
International	0.7 (0.3)	0.8 (0.4)	0.9 (0.4)	0.9 (0.4)
Difference	0.00	0.3**	0.00	0.00
Z	-0.54	4.65	-0.00	-0.31
p	.59	<.01*	1.00	.75

GSE: German-speaking Europe; International: international age-normative mean of the School AMPS; school motor: school motor measure; school process: school process measure; CI: confidence interval; Difference: contrast between GSE mean and international age-normative mean of the School AMPS.

* $p \leq 0.05$, two-tailed.

**Difference > mean SE.

slightly with age. This assumption is supported by studies researching the development of children living in GSE, confirming that ability increases with age [e.g. [22]]. Thus, the drop in the mean school motor measure at 8 years and the peak in mean school process measures at 6 years were unexpected.

Therefore, it appears that either rater scoring error or possibly, random selection variations [23] underlie those differences we did identify. Thus, given that only one out of eight mean differences exceeded the international mean *SE* of the School AMPS, and overall, 95% of the GSE participant school motor and school process measures were within ± 2 *SD* of the international normative means, we concluded that the results of this study suggest that the international age-normative means of the School AMPS can be used in practice and research in a GSE context, namely in German-speaking Switzerland, Austria, and Germany, provided the School AMPS raters retain their calibrated levels of severity.

Study limitations and directions for future research

Limitations of this study included the small number ($n < 30$) of participants in several age groups, lack of matching among age groups by country, applied convenience sampling procedures, and unknown socioeconomic or ethnic backgrounds of children included in this study. Further research on larger sample is recommended to verify or refute the results of this study, especially to determine whether or not there is a significant difference in mean school process measures for 6-year-olds and mean school motor measures for 8-year-olds between children from GSE and the total School AMPS sample.

Conclusion

Results from this study indicate that age-normative means of the School AMPS database are likely valid and can be utilised in research and practice to interpret the school motor and school process quality of schoolwork task performance measures of children living in GSE. Further, they likely can be used when determining whether a child performs below age expectations and needs occupational therapy interventions concerning schoolwork task performance.

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Disclosure statement

The authors report no conflicts of interest.

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